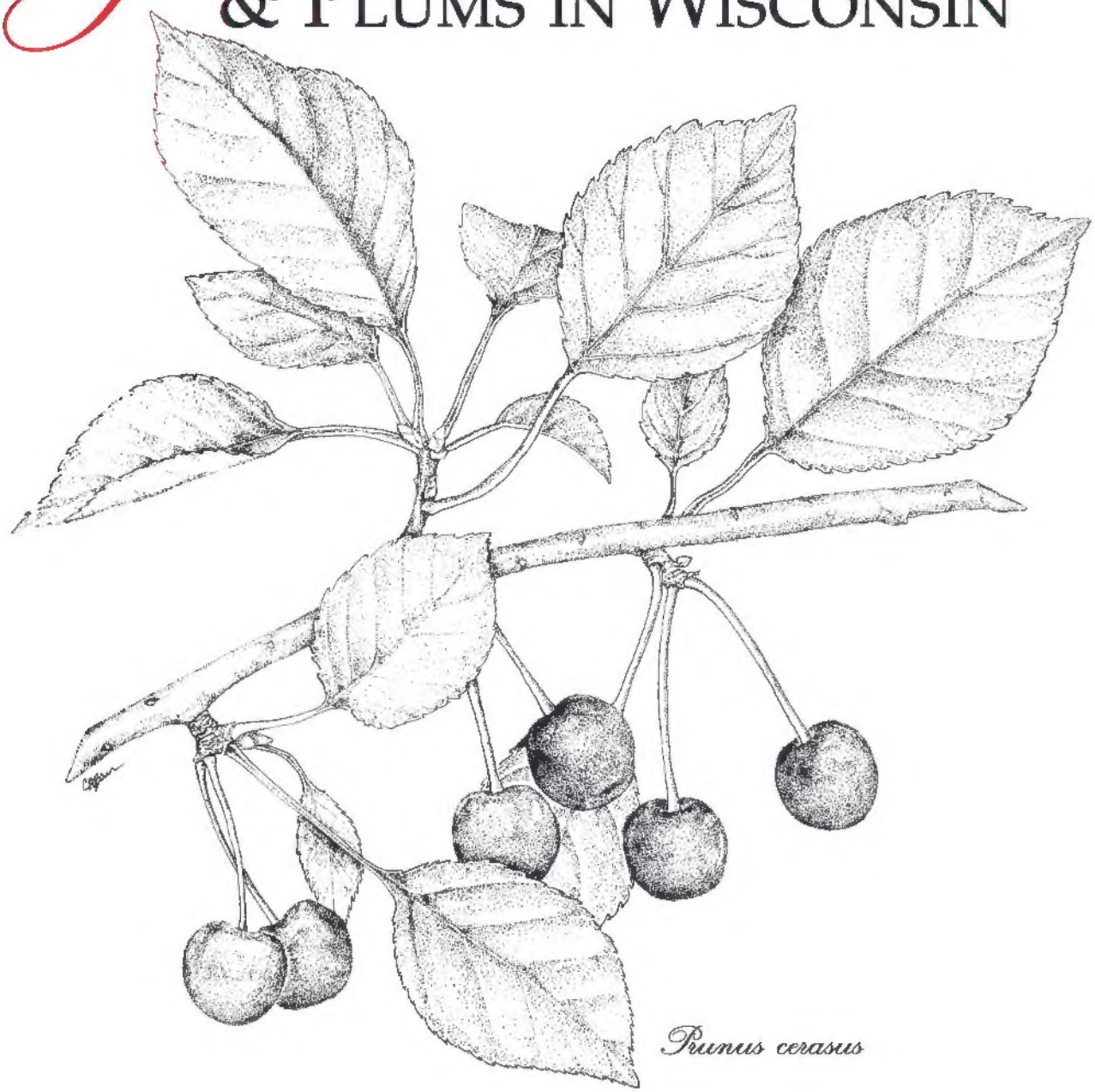
A3639

Growing Apricots, Cherries, Peaches, & Plums in Wisconsin



Prunus cerasus

Teryl R. Roper, Daniel L. Mahr, Patricia S. McManus

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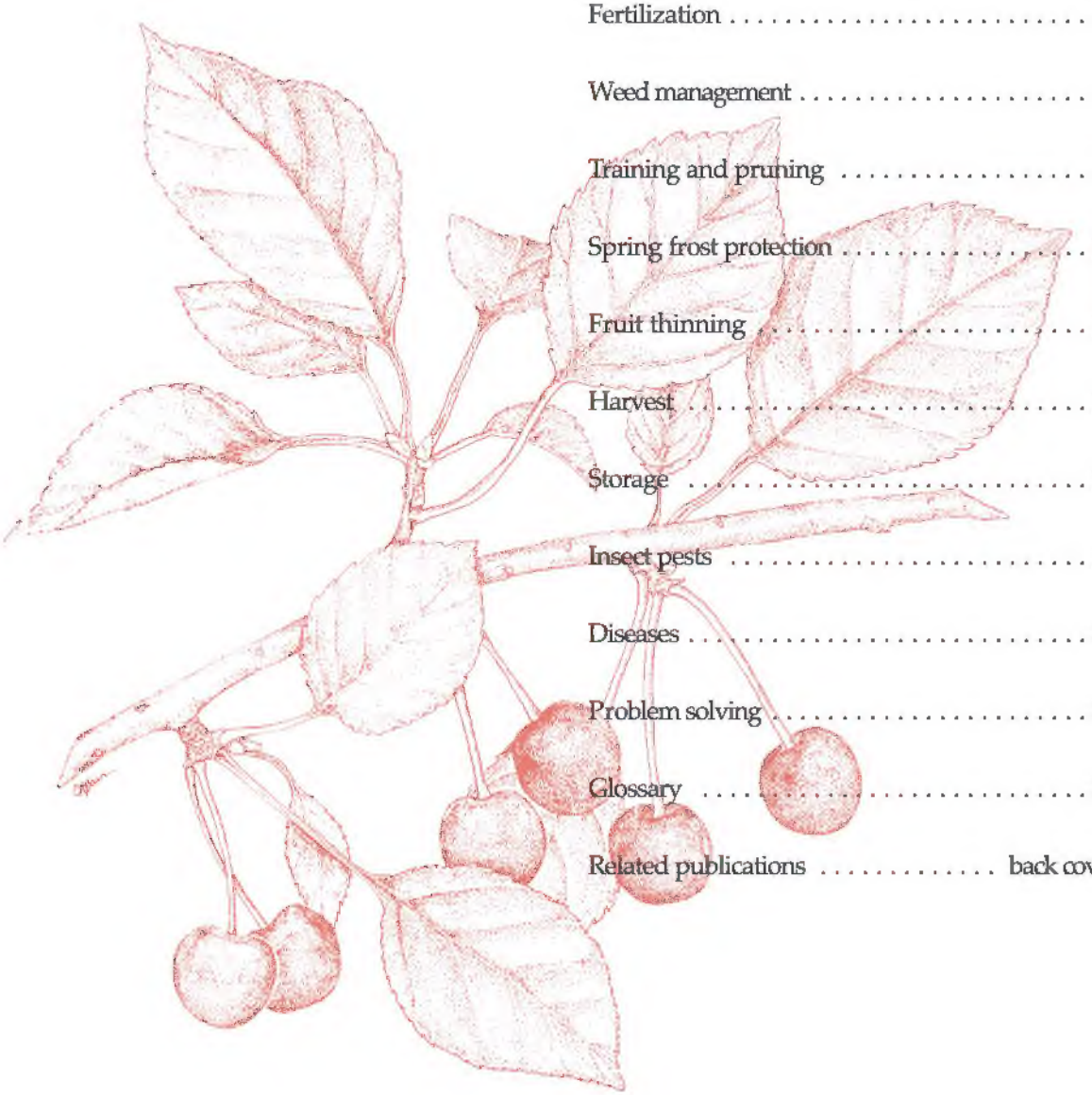
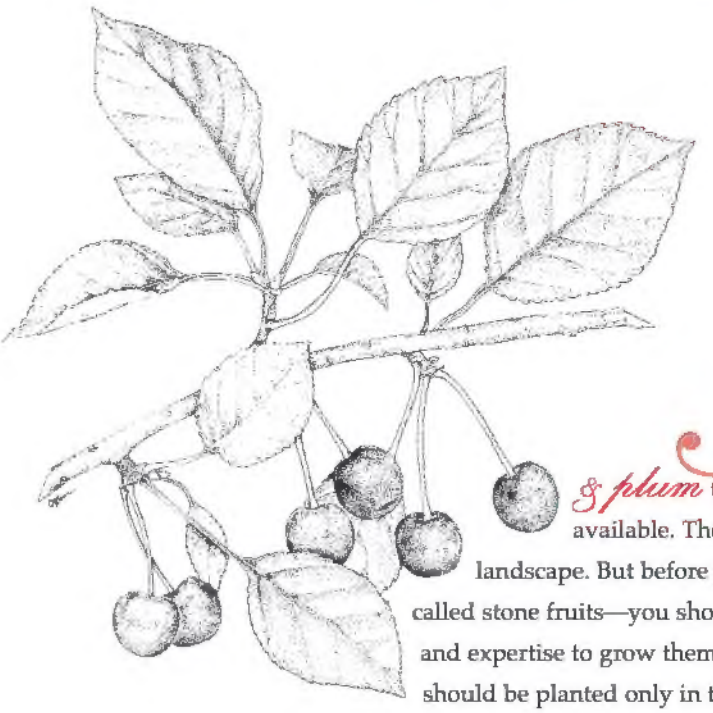


Apricots, Cherries, Peaches & Plums
In Wisconsin



Apricot, cherry, peach, & plum trees produce some of the most delectable fruit available. They can also be pleasing additions to your home landscape. But before planting any of these fruit trees—collectively called stone fruits—you should consider whether you have the time, space, and expertise to grow them successfully. To be successful, stone fruits should be planted only in the very best sites and raised with care.

Most stone fruit trees are very sensitive to winter injury. This results in short tree life and crops lost to spring frosts. Fruit buds of peaches, nectarines, and Japanese plums usually die if temperatures fall to 0°F. Lower temperatures will damage or kill the trees. Sweet cherries are slightly more hardy. European and native plums, tart cherries, and apricots have hardier fruit buds and wood than peaches or Japanese plums, but they may still be injured by severely cold winters, even in favorable sites.

Only tart cherries and European plums should be considered for commercial plantings in Wisconsin. Apricots, sweet cherries, peaches, and Japanese plums are not sufficiently winter hardy for commercial production. There is very little market for sand cherries and other exotic stone fruits.

This bulletin outlines the basics of stone fruit production for amateurs or hobbyists. For more information, contact your county Extension office.

The Stone Fruit Plant

All of the stone fruits belong to the genus Prunus. This genus is characterized by fruit with a hard inner seed—the pit—covered by a fleshy outer layer. The name "stone fruit" comes from this hard seed, or stone. Table 1 shows other characteristics of common stone fruits.

People have also produced hybrids such as plumcots, a combination of plum and apricot. Cherry plums will grow well in Wisconsin, but plumcots are not hardy here.

All stone fruits produce flowers and bear fruit on the sides of branches (laterally). Terminal buds—those at the ends of branches—always become leaves, not flowers or fruit. Stone fruit flowers tend to open from the outside lower portions of the tree and progress to the inside and top of the tree. Flowers may bloom on the sides of short shoots called spurs, which are found on wood that is 2 years old or older, or at the base of 1-year-old wood. Cultivars that bear fruit on spurs are more desirable because they are more productive than those that bear fruit on 1-year-old wood.

Some stone fruits are self-fruitful. That is, pollen produced by the flowers of one tree will fertilize each other successfully. Plants that are self-fruitful can be planted singly. Cross-fruitful trees require a second cultivar planted nearby, usually within 100 yards. Even some self-fruitful stone fruits will bear heavier crops if a second, compatible cultivar is planted alongside.

Stone fruit trees purchased from nurseries consist of two parts: the scion, which is the aboveground portion of the tree that produces fruit, and the rootstock, which is below ground and provides support to the tree while absorbing water and nutrients (figure 1). Nurseries graft these two parts to produce the stone fruit trees you may buy. Both parts of the tree are important and should be considered before purchasing trees. Not all stone fruit rootstocks are hardy in Wisconsin. Suggested rootstocks for each species are outlined in Extension publication Rootstocks for Fruit Trees in Wisconsin (A3561).

The trunk and branches of stone fruit trees provide structural support for the crops of fruit and may be manipulated to grow in a number of ways. Limbs with wide crotch angles relative to the trunk are stronger than those with narrow

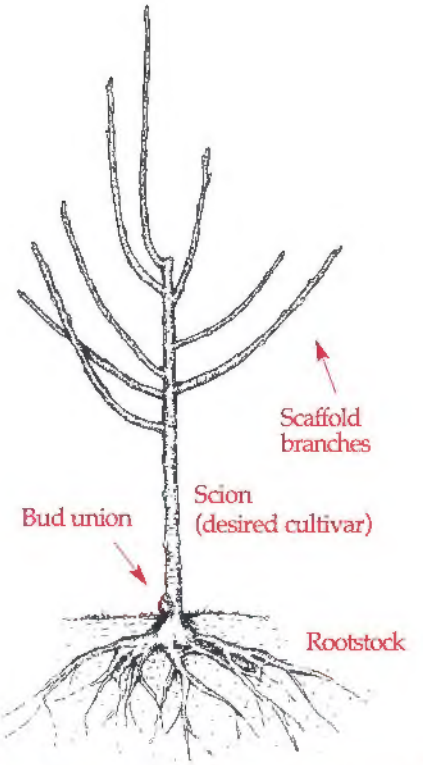


FIGURE 1. Important parts of a young stone fruit tree. The bud union shows where the rootstock and the scion were joined by grafting.

TABLE 1. Characteristics of common stone fruits grown in Wisconsin. All belong to the genus *Prunus*.

Common name	Species	Fruit size	Pollination	Space
Apricot	P. armeniaca	medium to small	self[1]	125 sq. ft.
Tart cherry	P. cerasus	small	self	100 sq. ft.
Sweet cherry	P. avium	small	cross[1]	150 sq. ft.
Peach and nectarine[2]	P. persica	large	self	125 sq. ft.
Sand cherry	P. besseyi	very small	cross	40 sq. ft.
Nanking cherry	P. tomentosa	small	cross	40 sq. ft.
Plums	P. domestica	medium	self[1]	125 sq. ft.

[1] Some exceptions exist to the pollination requirements indicated. Your nursery can provide more information about specific cultivars.
[2] Nectarines are peaches that have been bred not to produce fuzz.

crotch angles. Limbs should not branch off from the trunk at the same height, because this is detrimental to the trees.

Through photosynthesis, leaves produce carbohydrates that provide for both fruit growth and the growth of the tree. Leaves that grow in the shade cannot produce sufficient carbohydrates. Trees should be trained so that branches do not shade each other and receive sun for at least three-fourths of the day.

Site selection and preparation

Once a fruit tree is planted, it's not easy to move it to a better location. So, you should plant in a well-prepared, suitable site. Begin site selection and soil preparation the season before planting. Planning ahead allows time to adjust the soil pH, control perennial weeds, and improve the soil.

The ideal site for stone fruit trees is a gentle slope, where cold air can settle into adjacent lower areas. The bottoms of valleys are "frost pockets" and may be several degrees colder than nearby hillsides. Hilltops are also undesirable, as they may be very windy and exposed.

Stone fruit trees will grow best in fertile, sandy loam soils, though they will grow in all but the rockiest or heaviest clay soils. The soil must have good internal drainage, as fruit trees will not grow with "wet feet." The soil should be neutral to slightly acidic, with a pH of 6 to 7.

Since fruit trees require full sun at least three-fourths of the day, shady locations are not suitable.

Site selection also means making sure you have sufficient space for your trees. Table 1 shows the approximate area various stone fruit trees will occupy, ranging from 40 to 150 square feet. Some stone fruit trees can become quite large, so make sure to allow plenty of room for each tree.

Once you select a suitable site, begin soil preparation. Control perennial weeds either by repeated tillage or by using non-residual herbicides. Herbicides containing glyphosate, such as Roundup or Kleenup, are well-suited to perennial weed control. But be careful not to spray these herbicides on desired plants, because glyphosate will kill any plant it contacts.

You should also take a soil test of the site to a depth of 6 inches. Follow the soil test recommendations to adjust soil pH: add lime if the soil is too acidic, or add sulfur if the soil is too alkaline. To improve soil tilth, aeration and water-holding capacity, add organic matter such as manure, leaves, or compost. For information on how to sample soil and where to send samples for testing, see Extension publication Sampling Lawn and Garden Soils for Soil Testing (A2166).

Selecting plant material

Stone fruits are less hardy than apples and pears. You must choose cultivars carefully to have any opportunity for success. When choosing a cultivar, consider the intended use (fresh eating, jam or jelly, canning, freezing), flavor, and color. Remember, the cultivar must be winter hardy in your area. Peaches and sweet cherries should be planted only in southern Wisconsin, and even then you should choose only the hardiest cultivars.

You'll need to know whether the cultivar you're considering is self-fruitful or requires a second cultivar nearby. Table 1 lists the pollination requirements of different stone fruits. For cross-pollinated fruits, you should be sure that the two cultivars flower at the same time so they can provide pollen to one another. In addition, some sweet cherries are cross-incompatible, which means that successful pollination may require a third cultivar. Your nursery should be able to advise you in selecting cultivars. Pollinizer trees should be planted within 100 yards of each other for effective cross-pollination.

Don't let nostalgia for old cultivars influence your choice. New cultivars frequently have better flavor, texture, hardiness, and store longer than old cultivars. More information on cultivars well-suited to Wisconsin can be found in Extension publications Home Fruit Cultivars for Southern Wisconsin (A2582) and Home Fruit Cultivars for Northern Wisconsin (A2488).

Peaches are not generally recommended for Wisconsin. However, in extreme southeastern Wisconsin thousands of home gardens have peach trees that bear fruit. The peach cultivars most likely to succeed are Reliance, Harrow Beauty, and Madison, all of which are self-fruitful. Apricot cultivars include Goldcot and Harcot. Sweet cherries that may survive in Wisconsin include Gold, Hedelfingen, Lapins, and Van. Lapins is self-fruitful; the others require cross-pollination.

Rootstock selection

Stone fruit trees available at commercial nurseries are typically grafted or budded to combine a desirable scion to a rootstock with desirable characteristics. Nurseries do not propagate stone fruits from seed since the offspring will not be identical to the tree that produced the seed.

Rootstocks are very important to fruit trees, because they control tree size and may be more or less winter hardy than the scion. Unfortunately, at the time of this writing there are no reliable dwarfing rootstocks for stone fruits that are winter hardy in Wisconsin. A discussion of rootstocks for common stone fruits is found in Extension publication Rootstocks for Fruit Trees in Wisconsin (A3561).

Procuring plant material

It is best to purchase stone fruit trees directly from a reputable nursery or garden center. Good nurseries will sell only trees that are free of known viral diseases and true to the cultivar's name. Some advanced hobbyists and commercial growers propagate their own trees, but this is risky. While propagating procedures for stone fruits are straightforward, the operations take skill and practice. The typical success rate for amateurs is less than 25%. Further, good nurseries discard weak plants which amateurs might try to save.

Stone fruit plant	Rootstock
Apricot	Manchurian apricot seedling
Cherry (sweet or tart)	Mahaleb seedling
Plums	Myrobalan seedling
Peach and nectarine	Siberian C or Bailey seedling

Planting

Stone fruit trees must be planted correctly for best results. Transplant trees in the spring, after severely cold weather has passed and the soil has dried and warmed. Fall planting of bare root fruit trees is not recommended in Wisconsin.

Potted fruit trees may be planted any time of the year if given proper care. The procedure for planting bare root and potted trees is similar.

Bare root. If trees arrive from the nursery before they can be planted in your area, keep them in a cool place but don't allow them to freeze. Open the container and make sure the roots are still moist. If not, add a small amount of water to moisten the roots, but don't saturate them. You may soak the tree roots in a bucket of water for 2 to 4 hours before planting to moisten the roots.

Potted. Potted trees may be kept for 2 to 3 weeks in the container. Potted trees need regular watering, but don't overwater them. The soil should dry slightly between waterings. Remove the tree from the pot before planting and spread the roots. If the roots circle the inside of the container, make several vertical cuts through the roots and spread them away from the trunk.

When you are ready to plant the tree, dig a hole large enough to accommodate the roots without cutting or bending them. If one root is very long, it can be shortened, but in general don't prune the roots. The hole should be deep enough so the entire root system will be in the ground. Don't add fertilizer or fresh manure to the hole. Fill the hole with soil and gently pack it in with your foot to ensure good contact with the roots. Water

the tree immediately. Most stone fruit trees will be grafted from seedling rootstocks, and the graft union of these trees should be planted at or slightly above the final soil surface.

Young trees should be staked at planting. Suitable staking materials include ¾-inch metal electrical conduit, pressure-treated 2 x 2 lumber or 2- or 3-inch-round wood stakes. Drive the stake into the ground 3 to 4 inches from the tree and use tape (masking, PVC, electrical) or fabric strips to securely fasten the tree to the stake. Do not use wire, rope, or other materials that will not allow the tree to expand as it grows. You will need to periodically inspect the tape or other fastening materials for wear.

Irrigation

Young trees benefit from regular watering. During the first year, a stone fruit tree should receive 1 to 2 inches (3 to 5 gallons) of water weekly. If rain is insufficient, you must provide water. As trees get older their roots explore a larger volume of soil, and irrigation becomes less critical. Don't wait for trees to wilt or show other signs of water shortage before watering. On the other hand, overwatering can be equally detrimental. Overwatering fills air spaces in the soil and keeps oxygen from reaching the roots. Wet soils also have a greater potential for root rots. Measured watering throughout the season, from planting to leaf fall, will be most beneficial. Don't ignore the trees once the fruit have been harvested. Sufficient water is still important.

Pruning at planting

Newly planted trees may need to be pruned. The exact pruning to be done depends on the shape you desire for the tree. Prune unbranched "whip" trees to 30 to 40 inches tall. Pruning encourages strong lateral branches to form just below the cut. You control the height of the lowest branches by the height of your cut. These branches will form the basic framework of the tree. More information on pruning is provided in the "Training and Pruning" section.

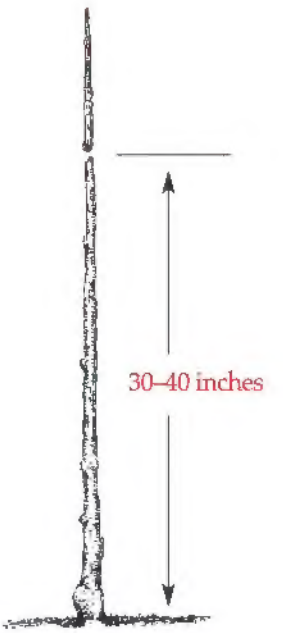


FIGURE 2. An unbranched "whip" tree at planting. Remove the top of the tree 30 to 40 inches above the final soil line. Branches will arise just below the cut.

FERTILIZATION

Like all plants, stone fruit trees require some essential minerals in order to grow. Have your soil tested the year before planting fruit trees and incorporate all recommended nutrients into the soil. Micronutrients such as zinc, copper, and boron are not required in great amounts, and fertilizing with these nutrients is usually not needed in Wisconsin.

You can apply nutrients as granules, liquids, or manures. Granular fertilizer is usually the least expensive form and is easy to apply. Incorporate granules into the soil by tilling or watering within 24 hours after application. Liquids can be applied with a hose-end applicator or watering can. Dilute liquid fertilizers according to package directions. Manures are typically low in mineral content and should be aged before shallowly incorporating them. Extension publication Organic Soil Conditioners (A2305) offers more information about organic fertilizers.

A few weeks after planting you can make a light application of a fertilizer containing nitrogen. Apply the fertilizer evenly within the drip line of the tree (the ground area under the tree's canopy). The rule of thumb is to apply 1 ounce of actual nitrogen to each tree per year of tree age, but not to exceed 1 pound of actual nitrogen per tree annually (around year 14). Be sure to include any fertilizer applied to lawns under trees in your total annual amount.

To calculate the amount of fertilizer to apply, divide the nitrogen needed, according to this rule, by the percentage of nitrogen in the fertilizer. For example, a 3-year-old tree should receive 3 ounces of actual nitrogen. To calculate how much ammonium nitrate (which is 33% nitrogen) to apply, divide 3 ounces by 0.33 for a total application of 9 ounces of fertilizer.

You may need to adjust the standard nitrogen application to the tree's actual growth. Shoots on young stone fruit trees typically grow 15 to 20 inches each year, while shoots on bearing trees grow 8 to 15 inches annually. If growth is less than normal, apply 25% more fertilizer. If growth is more than normal, don't apply any nitrogen for a year.

Weed Management

Management of the soil around the trunk of the tree affects tree performance. Don't allow grass or other vegetation to grow within 18 inches of the trunk. A vegetation-free zone of 2 to 3 feet is even better. Grass and other vegetation compete with trees for water and nutrients. Grass growing up to tree trunks also makes it difficult to mow without damaging the trunk. Mower injury frequently kills home fruit trees.

Prevent weed and grass growth around tree trunks by cultivating, mulching, or applying herbicides. Cultivate shallowly (no deeper than 1 to 2 inches) to avoid damaging tree roots. Organic and inorganic mulches are ideal because they prevent weed growth and conserve soil moisture. Apply 3 to 4 inches of an organic mulch such as shredded bark, bark chips, or wood chips. Spread the mulch in a donut fashion around tree trunks (figure 3). Avoid heaping mulch around tree trunks. This can lead to fungal rots on the trunk or attract rodents that gnaw on the bark and may girdle the tree.

Herbicides containing glyphosate, such as Roundup or Kleenup, are the easiest to use to kill weeds growing around tree trunks. For young trees, wrap the trunk with aluminum foil or plastic wrap before applying herbicide. Apply glyphosate according to label directions and avoid getting spray on the trunk or leaves (or you!). Be careful not to get glyphosate on vegetation other than the weeds you want to remove, because it will kill whatever vegetation it touches. Spray herbicides only when winds are calm.

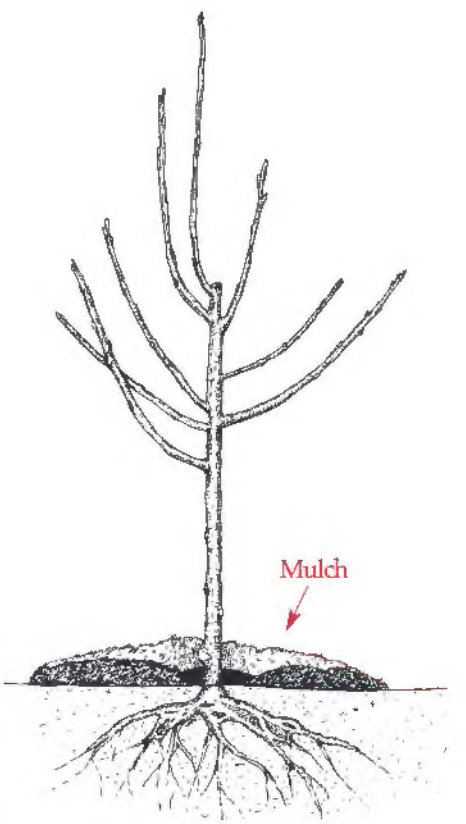


FIGURE 3. To keep weeds away from trees, pile organic mulch around the base and mold it in a donut shape. Don't heap mulch against the trunk because this can contribute to fungal rots or attract rodents.

TRAINING AND PRUNING

Annual training and pruning is essential for producing large yields of high-quality stone fruits. Training and pruning should be aimed at accomplishing these goals:

- **Light management.** All limbs of the tree should receive light. The tree should not shade itself.
- **Size containment.** Don't allow trees to become larger than their allotted space, nor too large to prune or harvest.
- **Renewal of fruiting wood.** Apricots and peaches produce fruit only on 1-year-old wood and must be pruned to encourage new growth to provide fruiting wood. Once they begin fruiting, make a few large cuts each year to encourage development of fruiting wood for next season.

Stone fruit trees are pruned the same at planting and are treated generally the same the first year. After the first year you'll need to select one of three training systems: open center, central leader, or modified leader. Each system is described on the following pages.

Regardless of the training system, each year you should remove any dead or broken branches, suckers, water sprouts, and branches forming narrow angles with the trunk that cannot be spread. Remove the weakest of crossing or closely parallel branches. Remove downward-growing branches. Thin out dense areas, particularly in the top of the tree. Thinning cuts (removing an entire branch to its point of origin) are better than heading cuts (removing a portion of a branch) for making trees less dense. Keep the height of tall trees manageable by cutting tall branches in the tops of the trees back to a weak lateral branch.

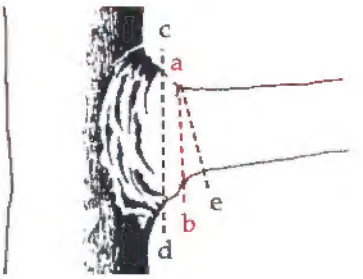


FIGURE 4. Prune branches close to the trunk, as along line a–b. Be careful not to cut too close to the branch collar, as along line c–d, and do not make stub cuts, like line a–e. Pruning along line a–b allows the cut to heal most quickly.

Use tools specifically made for pruning, such as hand shears or long-handled loppers. Keep them sharp and clean. Don't use hedge shears—manual or electric—because they make jagged cuts. Do not leave stubs when pruning. Make cuts close to the trunk, but do not remove the branch collar (figure 4). These cuts will heal most quickly. Do not use pruning-wound paints or coatings, as they keep the wound moist, allowing insects and diseases to invade the tree. It is best to allow the wood to dry naturally. The tree will produce growth that covers the cut.

The best time to do major pruning is while the trees are still dormant in spring (March and April). Dense canopies can be thinned again in late summer (late July and early August), but don't prune after mid-August as this can delay dormancy and predispose trees to winter injury.

Open center

This system will produce vase- or bowl-shaped trees with good light distribution in the canopy, but its structure may be weaker than that of central leader or modified leader trees. Peach trees are usually trained to an open center form.

First year spring. During the first year of growth, lateral branches should be encouraged to develop strong, wide crotches. Do this by spreading the branches with clothespins or toothpicks when they are no more than 6 inches long (figure 5). In the first dormant season after planting, cut the central leader out of the tree just above the uppermost scaffold limbs.

Second year spring. Remove about 25% of the extension growth from branches by cutting just above a strong, outward-facing bud to encourage further branching.

Third year spring. Remove any branches growing vigorously into the center of the tree. Also remove any weak, downward growing branches. Unless few lateral branches have been formed, don't cut the tips off branches. Continue with maintenance pruning to prevent shading, to keep the canopy open, and to maintain tree size.

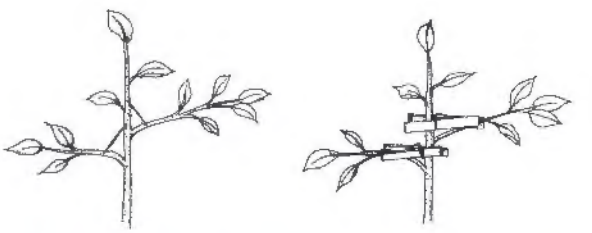
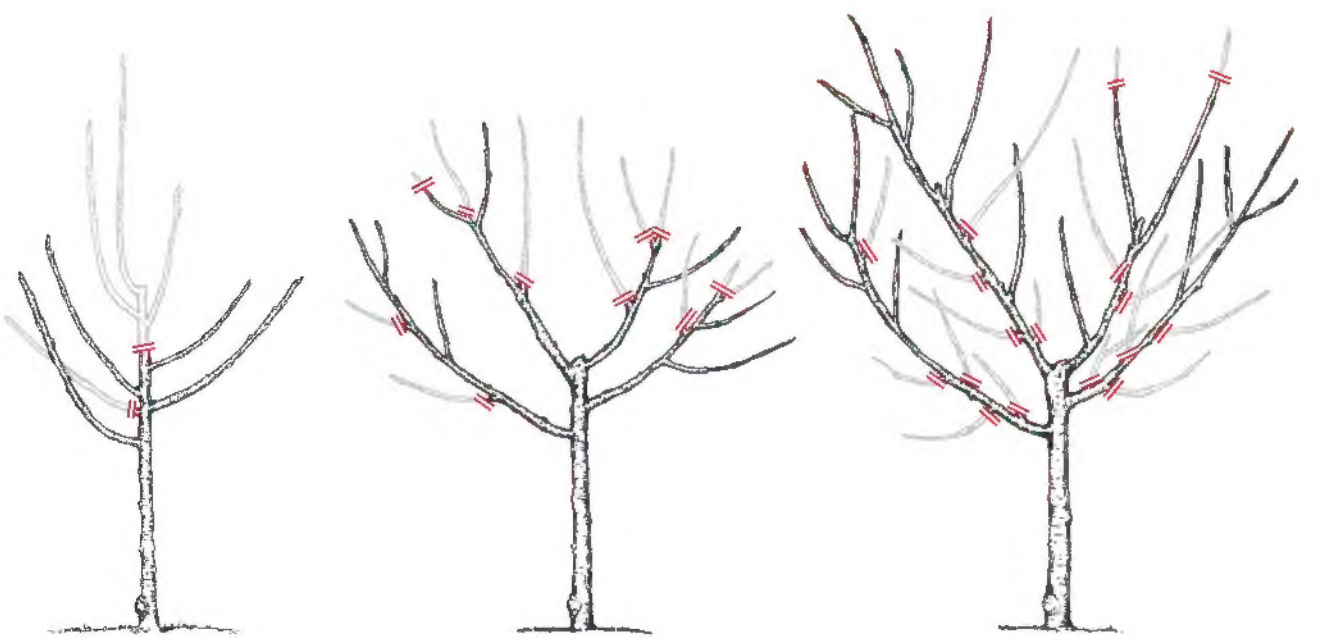


FIGURE 5. Use clothespins or toothpicks to spread branches that are no longer than 6 inches. Wedge toothpicks between the trunk and branches. Attach spring-type clothespins to the trunk and position them against branches.

OPEN CENTER



First year spring **Second year spring** **Third year spring**

Central leader

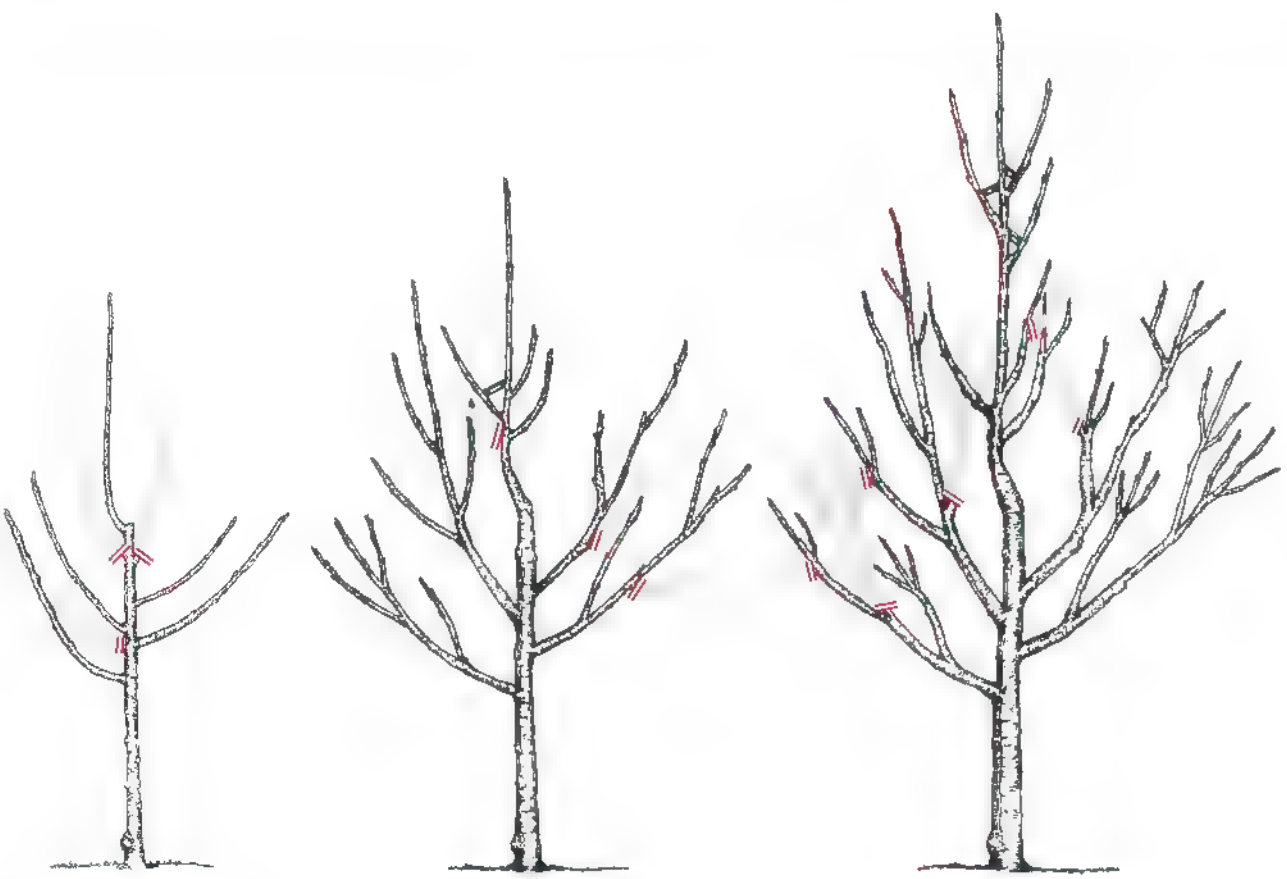
The central leader system calls for training a tree to grow with a Christmas tree shape (conically). The tree has one major vertical trunk with three or four tiers of lateral scaffold branches. The upper limbs should always be shorter than the lower limbs so the tree does not shade itself. You can easily train sweet cherries to a central leader.

First year spring. Select four to six lateral branches to be the lowest tier of scaffolds. These should have wide crotch angles and should be evenly spaced around the trunk. Prune out the remaining branches. If the lateral limbs have not branched, you may wish to remove 25% of their length to induce branching.

Second year spring. By this time the central leader should be tall enough to have a second tier of scaffolds. If branches have grown starting 25 to 30 inches above the top scaffold of the lower tier, leave them. If not, cut the leader 25 to 30 inches above the top scaffold. This will induce branching for the second tier of scaffolds.

Third year spring. When the central leader has grown 25 to 30 inches beyond the second tier, repeat the procedure for the third tier.

Central leader



First year spring | Second year spring | Third year spring

Modified leader

The modified leader is a hybrid of the open center and the central leader system. The advantage of this system is that there is more fruiting wood so the tree should produce better than an open center tree. Apricots, plums, and tart cherries are frequently trained to a modified leader system.

First year spring. Select four to six lateral branches to form the lower tier of scaffolds. Look for branches that have wide crotch angles and are evenly spaced around the trunk. Prune out the remaining branches.

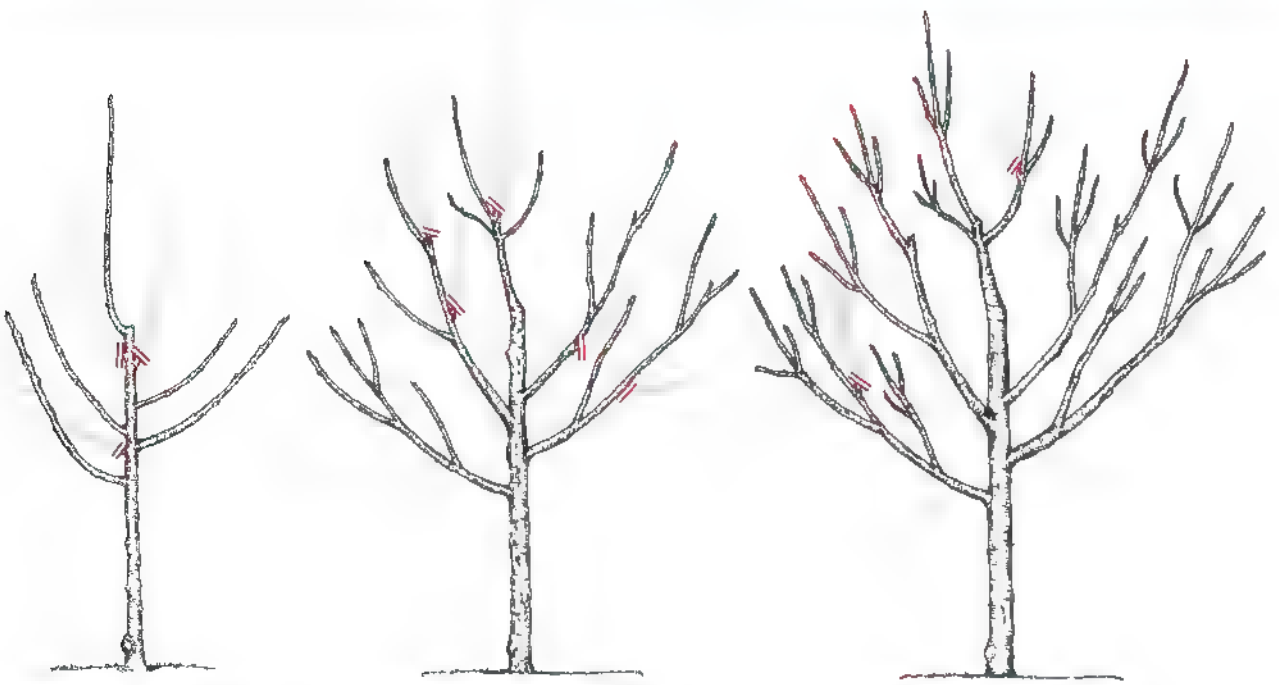
Second year spring. To produce the second tier of scaffolds, select four to six more branches beginning about 20 inches above the lower tier. Once the second tier is in place, remove the central leader.

Third year spring. Remove weak branches and any branches that grow inward, downward, or that cross.

Pruning old, overgrown trees to restore production of high-quality fruit is difficult if not impossible. Neglected trees will never produce as much high-quality fruit as new trees.

To lower the height of a tall tree, remove one or two of the tallest limbs. Make the cut where the limb joins the trunk. Such heavy pruning cuts will stimulate the tree to produce more vegetative growth, especially near the cuts. Spread heavy pruning over 2 to 3 years. The interior of dense canopies may need to be thinned out in order to allow light throughout the tree canopy.

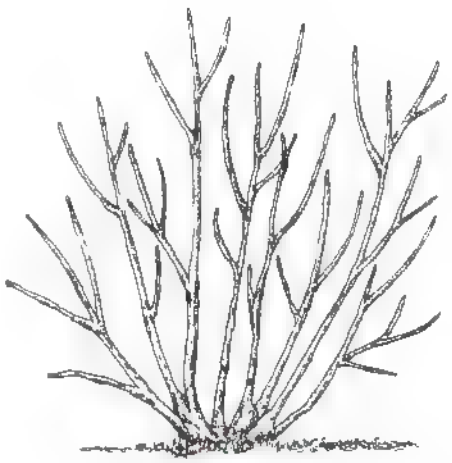
Modified leader



First year spring | Second year spring | Third year spring

Training bush cherries

Nanking cherries and sand cherries are usually trained as bushes rather than as trees. New shoots arise annually from the roots. These need to be thinned out every year to retain productivity. Shoots older than 5 years are less productive and should be removed to allow room for younger, more productive shoots. Cut old stems as close to the ground as possible. Thin out the total number of stems and branches in the canopy so that light is well-distributed and no branches are continually shaded



Before

After

Spring frost protection

The potential for spring frost injury can be limited by planting stone fruit trees in only the best sites (see "Site Selection") and by planting late-flowering cultivars. However, in Wisconsin late spring frosts are common, and stone fruit trees—apricots in particular—bloom early

In addition to plant and site selection, two other techniques can be used to protect flowers or immature fruit from late frosts. Covering trees with tarps of some sort will hold heat in the tree canopy. The tarp must be in place before the temperature falls below 34°F and must remain in place until temperatures are above freezing the following morning. Secure the tarp to the tree or the ground to prevent it from blowing off during the night. You may provide additional heat by placing a lighted, 60- to 100-watt light bulb inside the tree canopy. The idea is to provide more heat to keep the temperature under the tarp and within the tree canopy above 30°F. The tarp must be removed the next day before heat builds up inside the canopy. Keeping the canopy warmer during the day may hasten fruit development and make the fruit even more susceptible to later frosts.

Low-volume sprinkling can also be used for frost protection but is not recommended for home gardeners. Protection depends on keeping a continuous film of unfrozen water on the tree branches and flower buds for the entire night. As the water freezes into ice, it releases heat and keeps the temperature at or above 30°F. Sprinkling must continue until the air temperature is above freezing. This method will protect flower buds to about 20°F if there is little or no wind

Fruit thinning

During years with favorable weather, stone fruit trees may produce, or "set," large quantities of fruit. This will result in many small fruit at harvest. To avoid this situation, thin the crop by removing some of the immature fruit. To improve the size of the remaining fruit, thin as early as

possible after the fruit set and before they are dime-sized. The fruit of peach, plum, and apricot trees should be spaced at least 6 to 8 inches apart on a branch. Remove the smallest fruit and leave the larger ones. Large fruit early in the season will be large fruit at harvest. Thinning will result in fewer fruit of higher quality. Cherries and cherry plums are usually not thinned.

Harvest

One advantage of home-grown fruit is that it can be picked at peak ripeness, when it is both sweet and juicy. Fruit picked for commercial harvest must be harvested after it is mature, but before it is completely ripe to withstand handling and shipping

Different stone fruits ripen over a long period ranging from early July through September. You should harvest fruit when they are fully mature, but before they begin to fall from the trees. As fruit mature, they become softer and their flesh becomes sweeter and more juicy. The skin changes from a bright green color to a softer green, then to yellow, and finally to orange, yellow, purple or red. Usually the best way to determine if stone fruits are ripe is to taste the fruit.

All the stone fruits except sweet cherries are usually harvested without stems. Try to harvest the fruit by gripping it in the palm of your hand rather than with your fingers. This is not possible with small fruit. Twist the fruit slightly while pulling. Avoid pulling spurs or branches from the tree—these structures contain fruit buds for next year's crop. Sweet cherries should be picked with the stems if you plan to store the fruit for even a few days. If you plan to eat or process sweet cherries soon, you may pick them without stems. Gently place the fruit into your picking container. Never throw or drop fruit. If you must transfer fruit from one container to another, do so carefully to avoid bruising

You may need to protect fruit from birds that gather when the fruit begin to mature. Birds will peck holes in the fruit or eat the entire fruit, depending on alternate food sources and the number of birds. You can deter birds from eating almost-ripe fruit using netting or scare devices.

Netting is the most effective means of protecting fruit from birds. Bird nets are available from many sources, and satisfactory nylon netting can be purchased at fabric stores. To be effective, the entire tree canopy must be covered and the netting secured around the trunks. If the bottom of the net is left open, birds can still get in. It is, of course, difficult to net large trees, but this is still the best way to protect fruit.

You can deter birds, at least temporarily, with scaring devices. Aluminum pie tins hung from outer tree branches will protect trees for a few days. Mylar tape hung in trees can also be effective. Scare balloons have worked in some situations. Propane-powered cannons and electronic devices that emit bird distress sounds are effective for a time, too, until birds become acclimated to the sound. These noisemaking devices are not recommended in residential areas—no matter how understanding your neighbors are. Rotate methods during a season and delay using any scare tactic as long as possible for maximum effect.

Storage

Stone fruits are highly perishable and will only store for short periods of time, usually a few days to 2 weeks. Fruit will keep longer if it is picked slightly before its peak of ripeness and if it is cooled to 32° to 40°F as soon as possible. Store only sound fruit. Sort through the fruit and discard any that are blemished, diseased, bruised, or punctured. These will not keep well. Store fruit in perforated plastic bags to maintain high humidity levels. Table 2 shows storage times for stone fruits under optimal conditions.

TABLE 2. Stone fruit storage duration under optimum conditions, at temperatures of 32° to 40°F

Fruit	Duration
Cherries	
sweet	1–2 weeks
tart, sand, bush, and nanking	3–5 days
Apricots	1–2 weeks
Peaches	2–3 weeks
Plums	3–5 weeks, depending on type

INSECT PESTS

Many types of insects attack the foliage, fruit, or wood of stone fruit trees in Wisconsin. Not all of these occur at damaging levels every year or even everywhere they occur.

There are two approaches to insect management on stone fruits: a preventive approach where insecticides are applied routinely regardless of actual insect damage, and a curative approach where controls are applied only when pests are present and capable of causing significant damage.

The preventive approach is often used by growers who are unable to do routine pest monitoring or who are uncomfortable trying to identify pests and damage. A minimal preventive program uses one to three insecticide sprays per year, timed at petal fall, 2 to 3 weeks after the first spray, and 2 to 4 weeks before harvest. This spray program usually protects a substantial proportion of fruit. Where the best possible fruit quality is desired, or where insect numbers are high, a more thorough insecticide program may be necessary, with applications at 10- to 14-day intervals starting at petal fall and extending to harvest.

The curative approach is the best way to manage insect pests. It requires learning to recognize common pests and the types of injuries they cause, monitoring pest activity weekly throughout the growing season, and applying insecticides only when necessary. This approach allows the buildup of beneficial insects that naturally help to control many orchard pests.

Table 3 will help you determine when to monitor for the most serious insect pests. It summarizes when insects are likely to be present, and the best times to apply controls. Use the chart together with the detailed insect information below to decide when controls are appropriate.

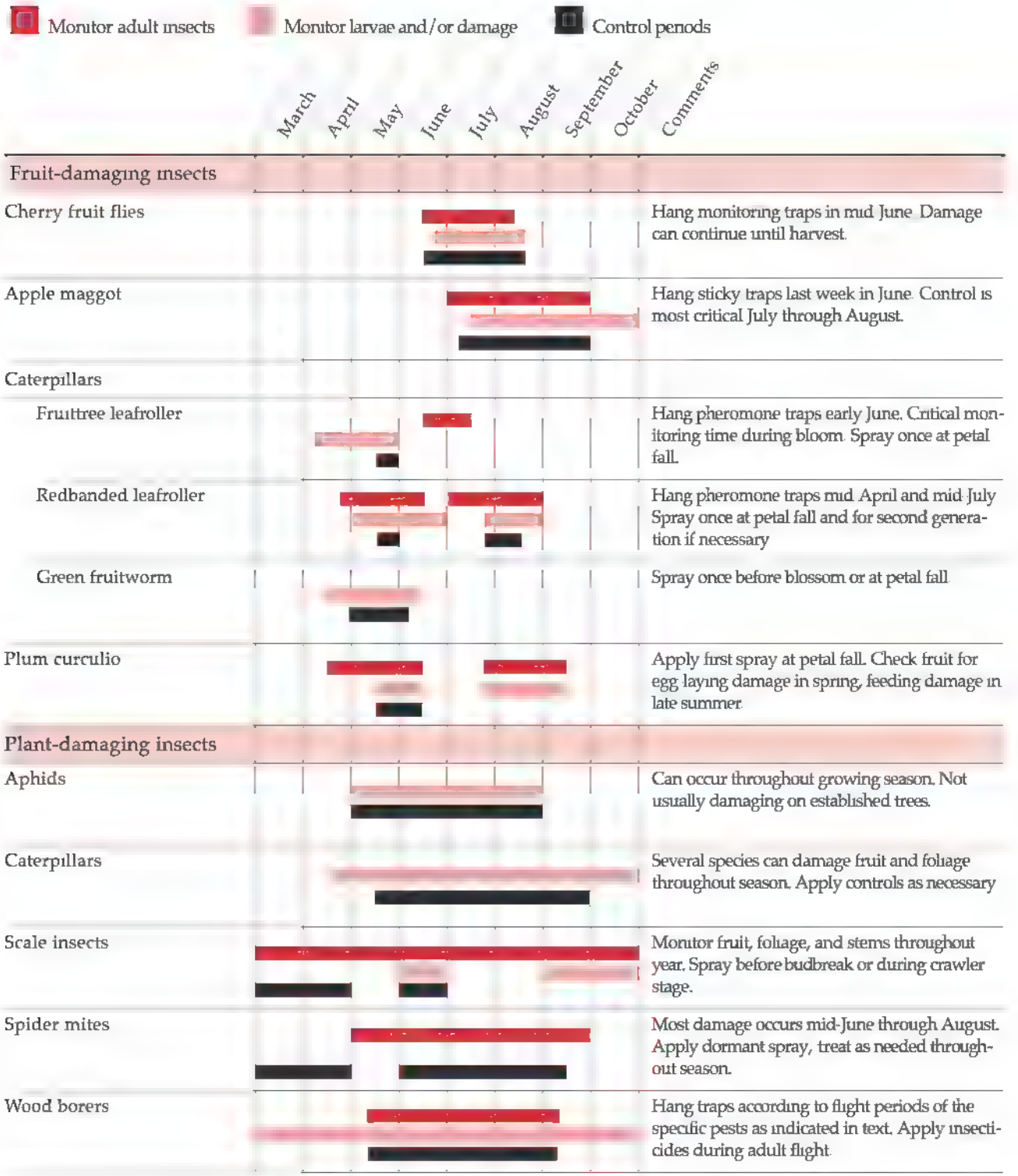
Several methods can be used to monitor insect activity, including sticky traps, pheromone traps, and visual inspection. Not all methods work on all insects. We offer specific suggestions for monitoring each pest listed below.

Pheromone traps are sticky traps with a synthesized attractant that mimics the natural odor or pheromone produced by female moths for attracting males for mating. The traps catch males and help identify the period when mating and egg-laying occurs. Traps can be purchased at better garden centers and through mail-order catalogs. For best results, follow the manufacturer's directions. You can find more information on insect trapping in Extension publication Insect Traps for Home Fruit Insect Control (NCR359)

Do not use insecticides during bloom. Stone fruits are pollinated by honey bees and other insects. Broad-spectrum insecticides applied during flowering will kill these beneficial insects and interfere with pollination.

The following descriptions are of the most serious stone fruit insects in Wisconsin. The insects are grouped by whether they primarily damage the fruit or the plant. More thorough and inclusive descriptions and color illustrations of insects and their damage can be found in Extension publication Common Tree Fruit Pests (NCR63). For additional information on specific pests and pesticides, see also the list of publications at the end of this book.

TABLE 3. Approximate dates for monitoring and controlling insect pests. Dates will vary depending on weather and location in state. Do not apply insecticides during blossom period.


Monitor adult insects
Monitor larvae and/or damage
Control periods
March
April
May
June
July
August
September
October
Comments
Fruit-damaging insects
Cherry fruit flies
Hang monitoring traps in mid June. Damage can continue until harvest.
Apple maggot
Hang sticky traps last week in June. Control is most critical July through August.
Caterpillars
Fruittree leafroller
Hang pheromone traps early June. Critical monitoring time during bloom. Spray once at petal fall.
Redbanded leafroller
Hang pheromone traps mid April and mid July. Spray once at petal fall and for second generation if necessary
Green fruitworm
Spray once before blossom or at petal fall.
Plum curculio
Apply first spray at petal fall. Check fruit for egg laying damage in spring, feeding damage in late summer.
Plant-damaging insects
Aphids
Can occur throughout growing season. Not usually damaging on established trees.
Caterpillars
Several species can damage fruit and foliage throughout season. Apply controls as necessary
Scale insects
Monitor fruit, foliage, and stems throughout year. Spray before budbreak or during crawler stage.
Spider mites
Most damage occurs mid-June through August. Apply dormant spray, treat as needed throughout season.
Wood borers
Hang traps according to flight periods of the specific pests as indicated in text. Apply insecticides during adult flight.

Fruit-damaging insects

The most serious insect pests of stone fruits are those that directly damage the fruit. These include cherry fruit flies, apple maggot, caterpillars such as leafrollers and fruitworms, and plum curculio.

Cherry fruit flies

Two closely related species of fruit fly attack sweet and tart cherries, but no other stone fruits. In addition to cultivated cherry, they also commonly infest wild cherries. Black cherry fruit fly and cherry fruit fly have similar life cycles and cause the same type of damage, and thus will be discussed together.

Type of damage. The adult fly punctures the fruit and lays its eggs within. After the eggs hatch, the larvae (maggots) tunnel through the fruit. The fruit may appear normal for several days, but eventually sunken areas develop. Usually only one maggot infests each fruit. If substantial infestation occurs near harvest, the damage may not be apparent externally. If the cherries are used for preserves, the small maggots may be a noticeable contaminant. Feeding injury not only damages the fruit directly, but also allows brown rot and other fruit diseases to develop. Eventually, the fruit will be completely unusable.

Description. Adult cherry fruit flies are about two-thirds the size of a common house fly. Black and white bands and spots mark the body and wings. The larvae are headless, legless, cream-colored maggots, about ⅓-inch long when fully grown. Young larvae are very tiny and virtually transparent, making them difficult to find within fruit, even with the aid of a microscope.

Monitoring. Cherry fruit flies are best monitored using yellow sticky traps. Black cherry fruit fly can begin flight as early as mid-June and will continue through mid-July, with peak flight in late June. Peak flight for cherry fruit fly is early to mid-July, with some continuing flight into early August. Therefore, traps should be hung in mid-June. Continue trapping until the end of harvest. Trapping efficiency can be improved by adding a spoonful of ammonium hydroxide to the traps. Place the liquid in a small jar or vial and hang it immediately under the trap. Some commercial traps already include another attractant called protein hydrolysate; if you use these traps, the ammonia bait is unnecessary.

Check the traps at least twice weekly. There is about a 1-week period between the time flies emerge and when their eggs are developed and ready to lay. Therefore, if you use an insecticide, the first application should be made about 5 to 7 days after the first fly is trapped.

Prevention and control. If possible, eliminate wild hosts such as choke cherry growing immediately adjacent to the orchard. However, cherry fruit flies are strong fliers and can move considerable distances

In small plantings, baited monitoring traps can be used to suppress cherry fruit flies, but several traps need to be hung in each tree. Trapping is not highly efficient and some fruit injury can be expected, especially in areas where populations are high.

Cherry fruit flies can be controlled with insecticides. In lightly infested areas, spray them in mid-June and repeat once or twice at 2- to 3-week intervals. Reduce the time between sprays in heavily infested areas. If using monitoring traps, time the first spray 5 to 7 days after the first catch, and then no more frequently than every 10 days. Cherry fruit flies can continue egg laying through the harvest period. If populations are high, it may be necessary to use an insecticide with a preharvest interval of 1 to 5 days—check the insecticide label for this information.

Apple maggot

The apple maggot is a type of fly closely related to the cherry fruit flies. The larvae tunnel throughout the fruit, causing it to deteriorate. As the name implies, the apple maggot is primarily a pest of apples. If uncontrolled, it is the most serious insect pest of apples in Wisconsin. It is also a summer pest of plum and apricot from July until harvest. Native hawthorns are also hosts.

Type of damage. The adult apple maggot fly lays eggs under the skin of fruit. It may lay several eggs in a single fruit. The fruit decomposes around the site of this sting, causing a small, darkened depression. Tiny, transparent larvae hatch from the eggs and tunnel through the fruit, leaving slender, brown trails. Infested fruit start to deteriorate and eventually fall from the tree.

Description. The apple maggot fly is about two-thirds the size of a common house fly. Its body and wings are marked with black and white bands and spots. The larvae are headless, legless, cream-colored maggots about ⅓-inch long when fully grown. Young larvae are very tiny and virtually transparent, making them difficult to find within fruit, even with a microscope.

Monitoring. Hang sticky traps during the last week in June and continue trapping until harvest. There are two types of apple maggot traps: yellow sticky boards and red sticky spheres. Yellow traps are less efficient but pick up insects before they start to lay eggs. The red sphere trap is efficient for monitoring reproductively mature flies. An "apple volatile" lure, available for hanging with the red sphere, greatly increases the attractiveness of this type of trap. Apple maggot traps are not as selective as pheromone traps; they catch many different types of insects. For this reason, it is important to be able to distinguish the apple maggot fly from other, similar insects. The two types of cherry fruit flies discussed earlier are easily mistaken for the apple maggot fly. You can identify them based on differences in wing pattern (see illustration). For management purposes, keep in mind that the cherry fruit flies attack only cherry, while apple maggot damages plum and apricot as well as apple and pear.

Wing-banding pattern of fruit flies

Prevention and control. Use, destroy, or bury infested fruit as soon as they fall from the tree. Do not compost these fruit because the larvae may survive.

Apple maggots can be controlled by trapping. Use the round red spheres along with the commercial apple volatile bait. Research shows that one trap per 100 fruit will catch most flies and will minimize fruit injury. In larger plantings, ring the planting with traps by hanging them every 50 feet along the edges of the orchard.

Apple maggots can be controlled with insecticides. In lightly infested areas, spray in early July and repeat once or twice at 2- to 3-week intervals. Reduce the time between sprays in heavily infested areas. Sprays can be timed by using traps to monitor for adult fly activity; spray when the first flies are caught, and again after subsequent catches, but no more frequently than every 2 weeks.

Caterpillars—leafrollers, fruitworms, and others

The larvae (caterpillars or "worms") of several types of moths feed on stone fruit foliage and fruit. Leafrollers (especially redbanded leafroller, obliquebanded leafroller, and fruittree leafroller) and green fruitworms are the most common, but others include inchworms and cankerworms. Most of these are early-season pests, causing damage shortly after bloom; a few cause damage in midsummer.

Type of damage. The larvae feed on both leaves and fruit. Young larvae feed on leaves during the blossom period, causing minimal damage to the tree. Leafrollers use silken webbing to roll leaves or tie two or more leaves together, creating a refuge where they live and feed. Leaves are often tied around clusters of young developing fruit, and the leafroller larvae feed on the fruit surface, causing superficial smooth or corky brown scars. Such damage caused early in fruit development may heal naturally. Although the fruit is scarred, the flesh will remain usable and won't rot. In contrast, green fruitworms do not tie leaves together, and they feed deeper, in young fruit only. Feeding damage from green fruitworms may cause the fruit to drop from the tree. More mature fruit in summer are not able to heal the fruitworms' feeding wounds, and they usually fall from the tree and rot. Leafrollers, green fruitworms, and similar caterpillars do not tunnel into fruit, but feed only from the surface.

These caterpillars feed on many types of broadleaf trees and shrubs, often in wooded areas adjacent to where orchards are planted. Most types also feed readily on other cultivated fruit plants, including apple, pear, and even berries.

Description. Leafroller larvae are pale yellow to pale brown and have a yellowish, brown, or black head, depending on the species. They grow from ⅛ inch long at hatching to about ¾ inch long. Green fruitworms are much larger and robust, growing to over 1 inch long. They are green and may have small white spots or pale lines which run the length of the body. The adults of these insects are moths

Monitoring. Check during the blossom period for signs of larval feeding, which may appear as tattered leaves or leaves with holes chewed in them. Also check for leaves that appear stuck together; carefully separate these to look for leafroller larvae. Pheromone traps are available for redbanded, obliquebanded, and fruittree leafrollers. Traps will help determine flight periods and therefore when eggs are being laid.

Prevention and control. Insect populations vary from year to year, depending in part on their numbers in nearby forests, wood lots, or abandoned fruit trees. In some years they may be essentially nonexistent, whereas in other years, noticeable defoliation or fruit injury may occur if the trees are not protected. Insecticide sprays applied at petal fall (the very end of bloom, when 75% of the flowers have fallen) will control most types of caterpillars. Traditional insecticides may be used. Also, microbial insecticides containing the active ingredient Bacillus thuringiensis will usually provide satisfactory control as long as they are applied when the larvae are very young

Plum curculio

Plum curculio is a native species of weevil—a type of beetle. As its name suggests, its preferred host is plum, but it attacks other stone fruits as well as apple and pear. Plum curculio is common throughout Wisconsin and is one of the most damaging pests of stone fruits.

Type of damage. Plum curculios damage fruit in three ways: egg laying, feeding by larvae within the fruit, and feeding by adults at the fruit surface. The adult female scars the fruit surface at egg laying by cutting small crescent-shaped flaps in the skin of young fruit. This damage occurs when the fruit are smaller than 1½ inches in diameter. As the fruit grows, it becomes very misshapen, with lumps and dimples. Larvae tunnel through the fruit, causing considerable deterioration and, eventually, fruit drop. Adults feed on the fruit surface, causing small, shallow irregular holes. The surrounding areas decay and rot.

Description. Adult weevils are less than ¼ inch long and are gray-brown to dark brown. The plum curculio has three pairs of bumps on the back, and a long, curved snout on the front of the head. The larvae are pale and grublike, with a distinct, pale-brown head but no legs. Fully grown larvae are about ¼ inch long

Monitoring. Monitor for adult weevils from mid-April through mid-June and again from late July through mid-September. To monitor, spread a white sheet beneath a tree, then sharply tap the branches with a padded stick. Adults will fall to the sheet and pretend to be dead. Check fruit for 4 weeks beginning shortly after petal fall; look for the characteristic crescent-shaped scars.

Prevention and control. Collect and bury windfalls as soon as they fall. Since the weevils can easily tunnel through soil, bury infested fruit at least 2 to 3 feet deep. If possible, remove vegetation from fence rows and eliminate other sites where beetles may overwinter. Chickens readily feed on migrating beetles and may reduce their populations some. Do not allow chickens to forage in areas treated with pesticides or where there may be pesticide drift or runoff. Appropriate insecticides applied at petal fall and 10 to 14 days later will provide good control.

Plant-damaging insects

Feeding by insects and mites on foliage or branches can hurt host trees various ways. The damage weakens trees so that they grow poorly; it reduces bloom and fruit set; and it results in the production of small, low quality fruit. The plant-damaging insects and mites include aphids, caterpillars, scale insects, spider mites, and wood borers

Aphids

Several types of aphids feed on the foliage and young stems of stone fruits throughout the growing season. Those most commonly found on stone fruits include the black cherry aphid (on cherries), green peach aphid (on all stone fruits), and apple grain aphid (on plums). Apple grain aphids may heavily infest buds and very young growth in spring, but they cause no injury and do not require treatment.

Type of damage. Aphids often cause newly developing leaves to twist and curl. They feed by sucking plant sap from leaves and small succulent stems. During feeding, they inject saliva into the plant to aid in feeding and digestion. Aphid saliva is often toxic to the plant, resulting in stunted, twisted, or curled leaves.

Description. Aphids are usually less than ⅛ inch long and are generally found in large colonies, often on the undersides of the leaves They vary in color from pale yellow to light green to pale rose to dark purple. Occasionally, winged individuals can be seen in the colony; these may differ in color from the wingless forms.

Monitoring. Check leaves throughout the growing season. Infested leaves will be curled, with the aphids feeding on the lower leaf surfaces. Clusters of small aphids are easy to see.

Prevention and control. Native natural enemies, such as lady beetles and lacewings, help control all aphids that attack stone fruit trees. Lacewing eggs can be purchased commercially

and released into the trees during bloom to augment local natural enemies; we do not recommend purchasing lady beetles because they disperse too rapidly after release.

An appropriate insecticide, applied at petal fall, will control aphids. Insecticidal soap will provide good control if coverage is thorough. Again, moderate aphid activity will not hurt established trees and usually does not warrant the use of broad-spectrum insecticides.

Caterpillars

Various caterpillar species are important defoliators of fruit trees. Some feed on fruit as well as leaves. Eastern tent caterpillar and fall webworm are common problems. Both caterpillars are relatively large and hairy. Eastern tent caterpillars spin densely webbed "tents" in early spring, soon after the first leaves have formed. The larvae first feed in groups, outside of their tents and return to their tents when not feeding. Several colonies can completely defoliate a tree. Fall webworms produce large, loose tents that surround the colonies of feeding larvae. There are two generations: spring and late summer. For a discussion of control, see the previous section on caterpillars in "Fruit-Damaging Insects."

Scale insects

Scales are tiny insects that feed by sucking sap from branches, leaves, or fruit. During most of their lives, scale insects are motionless and covered by a hard, waxy coating. The shape and size of the coating varies with species. The San Jose scale and oystershell scale occasionally infest Wisconsin stone fruit trees. Both types can also infest apple trees.

San Jose scale

Oystershell scale

Type of damage. Newborn scales, called crawlers, can settle on fruit. Their feeding leaves small, red halos (⅛ to ¼ inch in diameter) on green or yellow fruit. These marks appear more distinct as the fruit mature. In addition to injuring fruit, heavy infestations can stress trees and kill stems and branches.

Description. San Jose scale is very tiny, only about 1/16 inch when fully grown. Its covering is circular and looks from the side like a broad, flattened cone. It overwinters as a partially grown scale on the tree; females mature and produce crawlers by mid-June. Crawlers seek appropriate places to settle and start to feed. A second generation occurs in summer. Because of their tiny size and brown color, San Jose scales are difficult to see on branches or trunk, and they are usually noticed first when they start to infest fruit. By this time, the tree is usually infested heavily.

Oystershell scale is less common than San Jose scale but causes similar damage. It is slightly larger and elongated in the shape of a mussel shell. It overwinters in the egg stage under the scale covering of the mother. Eggs hatch 1 to 3 weeks after blossom and crawlers move about until they find an appropriate place to settle on the stems or branches of the tree; occasionally they will settle on young fruit. The scales grow slowly throughout the year, and there is only a single generation per year.

Monitoring. Because of their small size, scale insects are often overlooked unless they are abundant. If you notice the characteristic haloes on fruit, carefully examine the tree trunk and branches for scale colonies.

Prevention and control. Lime sulfur sprays or superior oil applied during dormancy controls both types of scale. Crawlers can be controlled with one to two applications of a conventional insecticide, timed 2 to 4 weeks after petal fall.

Spider mites

Size of a period. 1/50"

Spider mites are very tiny creatures that are more closely related to scorpions, spiders, and ticks than they are to insects. There are many different types of spider mites, all of which are plant feeders. Two types, European red mite and twospotted spider mite, commonly attack the leaves of stone fruits. European red mite is most common on plum, but also occurs on other stone fruits. Twospotted spider mite can be found on all stone fruits. Both also occur on apples, where they tend to be both more common and more damaging than on stone fruits.

Type of damage. Mites suck sap and nutrients from leaves. Their feeding damages leaf surfaces, causes moisture loss, and reduces the plant's capacity to grow and produce fruit. Damaged leaves first become slightly yellow, then take on a purplish or bronze coloration.

Description. Both species of spider mite are very tiny—only about 1/50 inch long when fully grown. Twospotted spider mites are pale yellow, with a large dark spot on either side of the body These mites produce very fine silken webbing along the leaf edges and veins, which becomes quite noticeable where their population is dense. European red mites are a dark, reddish brown, and they do not produce silken webbing. Both types of mites have many generations each year and can build to very high levels. They reproduce more rapidly in warm, dry weather and can average more than 100 per leaf.

Monitoring. Because of their very small size, it is helpful to have a 10- or 15-power magnifying glass when checking for mites. If you see leaf discoloration and suspect mites, check 10 randomly selected leaves from each tree. Most mites will be on the lower leaf surfaces. When smashed between thumb and forefinger, or against a piece of white paper, the mites will leave a small brownish stain. In early spring, check stems near buds for eggs of European red mites. If eggs are present, a dormant spray will control them.

Prevention and control. Spider mites rarely damage trees in home orchards except where broad-spectrum insecticides are frequently used.

Natural controls are important for regulating spider mites. Heavy rains wash many from leaves, especially on smaller or well-pruned trees. Many beneficial predators also occur naturally. These include tiny predatory mites as well as lady beetles, lacewings, and other insects that feed on mites. These beneficials are more prevalent when trees are not heavily sprayed with broad-spectrum insecticides

A dormant superior oil spray applied at the time of "tight cluster" (as the flower buds first become noticeable) will kill overwintering eggs of European red mite. However, this treatment is ineffective against twospotted spider mites, which do not overwinter on the tree. Insecticidal soap and certain types of conventional insecticides will suppress mites during the growing season, but may not provide complete control. If numbers are high, two applications 5 to 7 days apart may be needed. Commercial orchardists have access to specific miticides that provide effective control

Wood borers

Several types of wood borers can seriously damage and even kill stone fruit trees. The most important of these are peachtree borer, lesser peachtree borer, and American plum borer. The adults of all of these insects are moths. The peachtree borer lays eggs from late June through mid-August. The lesser peachtree borer lays eggs from early June through early September. The American plum borer has two generations per year, laying eggs from mid-May to mid-June, and again from mid-July through the end of August.

Type of damage. Eggs of all three species are most commonly laid near wounded areas of the bark on the trunk or major branches. Injuries susceptible to infestation include sun scald, frost cracks, lawn mower injury, injury from mechanical cherry shakers, and previous borer sites. Wood borers lay eggs on the surface of the bark or in bark cracks; the young larvae tunnel into the tree as soon as the eggs hatch. They tunnel

through the cambium layer right under the bark. The damage girdles the tree. When the infestation is in a branch, only that branch will show symptoms. If the injury is to the trunk, the entire tree will suffer. Symptoms include poor growth, small, sparse, and off-color foliage, and poor bloom and fruit set. If left untreated, the infested areas will continue to be reinfested over several years, and the tree will eventually die.

Description. The adult moths of peachtree borer and lesser peachtree borer have clear, scaleless wings. They are slender moths, peachtree borer being about ¾ inch long and lesser peachtree borer about ½ inch long. The general body color of both is a dark blue-black. Peachtree borer females have a distinct, orange band across the midpoint of the abdomen. The larvae of both these species are cream colored; the head is pale to dark brown. Peachtree borer larvae attain a length of about 1½ inches whereas those of lesser peachtree borer grow to about 1 inch.

The adult American plum borer is a moth about ½ inch long. The wings are covered with scales. The front wings have a pale gray-brown background color, with a broad, dark, irregular band a little more than halfway from the wing base. The larvae grow to about 1 inch. The larval color can vary from dirty white to grayish purple to dark red. The head can also vary in color from pale to dark brown.

Monitoring. All three insects can be monitored with pheromone traps. Also, look for signs of necrotic or loose bark that may have oozing sap, or holes with sawdust-like material. When such areas are found, use a sharp knife and carefully cut away the bark to determine if larvae or their galleries (tunnels) can be found.

Prevention and control. Prevent injury to the trunk and branches of trees, so that wood borers don't lay eggs there. You can clean up isolated infestations by carefully cutting away the infested tissue, being certain to remove all larvae. You can then paint these areas with asphalt-based tree wound compounds, which will retard reinfestation. Insecticides directed with a hand-held spray wand at the trunk and lower branches should be timed when the insects are flying and laying eggs. This will require the use of pheromone traps and also proper diagnosis of the type of borer present.

Diseases

Many disease-causing pathogens (fungi, bacteria, viruses, and nematodes) attack stone fruit trees. Diseases may damage the fruit directly, making it unattractive or inedible, or they may weaken trees by injuring or invading the leaves, trunk and branches. Damage to the tree reduces productivity and increases susceptibility to winter injury or attack by additional pests. Since Wisconsin is near the northern limit for stone fruit trees, disease management is critical to produce quality fruit consistently. For specific recommendations on pesticide applications, see Extension publication Apricot, Cherry, Peach, and Plum Pest Management for Home Gardeners (A2130)

Brown rot

Brown rot is caused by a fungus (Monilinia fructicola) and is the most common disease of stone fruits in humid areas of the United States such as Wisconsin. All stone fruits are susceptible to brown rot, which damages flowers, twigs, and fruit. Warm, humid, and wet weather favor the development of brown rot. In years when these conditions prevail, entire crops may be lost in just a few days.

Infected blossoms wilt and turn brown but persist into the season. Infected twigs show small cankers that eventually expand and may girdle the branch. This causes the new growth at the ends of branches, or "terminal growth," to die. Mature fruit are more susceptible to brown rot than immature fruit. Initially, small, light brown spots develop on the fruit. Given favorable weather, these spots will expand rapidly and can destroy an entire fruit in only a few hours. An infected fruit may fall to the ground or persist on the tree as a "mummy."

Brown rot overwinters in these mummies, on the tree or on the ground. When warm, wet weather returns in the spring, the fungus ejects spores from mummies and other overwintering sites such as branch cankers. The spores spread by wind and splashing rain, causing primary infections of blossoms and twigs. Later, fruit are infected by spores from mummies, infected flowers, and previously infected fruits. Injured fruits are especially susceptible to infection.

Prevention and control. Management of brown rot begins by removing any infected fruit, mummies, and twigs from the tree and the surrounding ground immediately after harvest. This reduces the amount of overwintering fungus. Applications of fungicides, particularly early in the season during flowering, is usually necessary to manage brown rot. Additional applications beginning about 3 weeks before harvest may be necessary under heavy disease pressure. For more information see Extension publication Brown Rot of Stone Fruits (A8NYDS2).

Cherry leaf spot

Leaf spot is a major disease of both sweet and sour cherries in the Great Lakes area. It is caused by the fungus Blumeriella jaapii. A related species attacks plums. The disease first appears as small purplish spots on the upper side of leaves. The spots then turn brown. Only a few lesions per leaf are required before a leaf will turn yellow and drop. Severe infections may lead to partial or full defoliation of trees, which subsequently leads to smaller crops of soft, watery fruit with low sugar content. This is accompanied by a loss of vigor, which predisposes trees to winter injury or attack by other pathogens.

The disease overwinters in infected leaves under the tree. The release of spores from infected leaves coincides with the emergence of tender new leaves in spring. However, infection usually does not occur until after petal fall, when minute pores on leaves and stems, called stomata, open. Infection occurs through the stomata. Once primary infection has occurred, secondary spores may spread from the underside of infected leaves. With favorable conditions, secondary infection can continue until leaf drop in the fall.

Prevention and control. Removing fallen leaves from around cherry trees will break the disease cycle by not allowing overwintering spores to develop. If cherry leaf spot becomes established, treatment with fungicides at 10- to 14-day intervals from petal fall to harvest is usually required.

Perennial canker

Perennial canker (also called Valsa, Cytospora, or Leucostoma canker) is caused by the fungi Leucostoma cincta and Leucostoma persoonii. The disease is most severe on peach but also affects apricots, cherries, and plums. Perennial canker can kill limbs and entire trees. Cankers on trunks and branches are oval-shaped with swollen edges and may ooze an amber-colored gum. Gumming, however, is not unique to this disease.

The fungi overwinter in cankers or dead wood. Fungal spores are released during cool, wet weather. Mechanical and winter injuries, insect wounds, and leaf scars provide sites for spores to cause new infections. When a tree is growing vigorously, it produces a wall of callus tissue that limits canker expansion. However, when a tree is dormant or stressed, fungal growth is favored and cankers enlarge.

Prevention and control. The most effective way to prevent perennial canker is to keep trees in good health. Prune out cankered tissue from the tree by cutting near the base of the branch. Remove infected material from the site. Do not plant new trees near cankered trees. Avoid mechanical damage from lawn mowers. Winter injury can be minimized by applying white latex paint to the southwestern side of trunks and large limbs. To promote wound healing, delay extensive pruning until spring when warm, dry weather is forecast

Bacterial canker

Bacterial canker is caused by two closely related species of bacteria (Pseudomonas syringae pv. syringae and pv. morsprunorum). The disease will affect virtually any part of a tree. Branches and twigs will have visible cankers that may ooze a gummy material. Note that gumming is not unique to this disease. Infection is most severe during prolonged periods of cool, wet weather following bloom. Severely infected leaves will have reddish spots or a shothole appearance, and the leaves may curl inward

The bacteria overwinter in infected woody tissues. For infection to occur, there must be some opening for the bacteria to penetrate. The preferred openings are leaf scars and bud scale scars. The bacteria are usually spread by windblown rainfall and pruning shears.

Prevention and control. Some cultivars are more susceptible than others to infection, but you should assume that all cultivars are susceptible. Removing cankers reduces the population of the pathogen. Spraying trees with copper compounds in the spring before bloom and in the fall after harvest can suppress the bacteria. However, copper can be toxic to plant tissues and should not be applied to developing fruits. Training trees to have wide crotch angles helps prevent cankers.

Bacterial spot

Most apricot, peach, and plum cultivars are vulnerable to bacterial spot, a widespread problem in the eastern United States. Bacterial spot may infect leaves, fruit, and tender shoots. Leaf symptoms begin as small, angular, water-soaked areas on the underside of leaves. Severely infected trees may be defoliated, leading to stress and loss of vigor. When fruit are infected early, deep pits form in the flesh. Later infection of fruit results in a mottled skin.

The disease is caused by the bacterium Xanthomonas campestris which overwinters in cankers on the trees. In the spring, when growth resumes, bacteria ooze out of the cankers and spread via wind-driven rain. The bacteria must enter the plant through wounds, such as those caused by hail, or through a natural opening, such as a leaf scar. Periods of frequent rainfall and moderate temperatures favor development of the disease

Prevention and control. Keeping trees in good health by controlling other disease and insect pests and fertilizing properly will help prevent infection. Some cultivars are more resistant than others. Copper applications in the fall or early spring may suppress the disease but will not eliminate it.

Black knot

Black knot, caused by the fungus Apiosporina morbosa, can be a severe pest of plum and cherry trees. It is commonly found on wild plums and cherries, and this is an important source of infection even for backyard fruit trees. The most noticeable symptom of the disease is the production of dark brown or black swellings on the branches of plum and cherry trees. The knots tend to be longer than they are wide. The fungus overwinters in knots on infected branches. In the spring, the knots release primary spores, which are carried by wind and rain to infect other branches. Water droplets on limbs and temperatures between 55°F and 77°F are required for infection to occur. Several months later new knots will begin to appear on infected branches.

Prevention and control. Most cultivated, European-type plums and cherries are susceptible to black knot. Inspect trees several times per year for black knot and remove the lesions by pruning 3 to 4 inches below the infection. Fungicides applied to control brown rot or cherry leaf spot may help prevent infection, but spraying fungicides alone will not control the disease. For more information, see Extension publication Plum and Cherry Disorder: Black Knot (A2588).

Crown gall

Crown gall is caused by the bacterium Agrobacterium tumefaciens. The pathogen persists in the soil for many years and affects a wide range of herbaceous and woody plants. The bacteria invade roots and crowns through wounds such as those caused during planting or by insect damage. The bacteria stimulate an overproduction of plant hormones, causing tumorlike galls that can grow to 4 inches in diameter. The galls are initially fleshy and white but become firm and tan to brown when the tree is dormant.

Prevention and control. There is no known control for crown gall. Therefore, to prevent introducing it into your soil, carefully inspect the roots and crowns of new trees for any abnormalities. Do not plant trees in soil where plants previously had crown gall.

Viruses

Stone fruits are particularly susceptible to viruses. Viruses are very host-specific, so those that attack stone fruits will infect only stone fruits. Symptoms may range from yellowing leaves to dieback of terminal shoots to delayed bud break and leaf emergence to general stunting and loss of vigor. While viruses may be implicated in maladies that cannot be explained by other means, do not assume your tree is virus-infected just because you can't find another cause. Tests are available to verify infection with common viruses.

Sucking insects such as leafhoppers are usually implicated in the spread of viruses. When insects feed on an infected tree and then on an uninfected tree they may pass the virus to the latter. Prunus necrotic ringspot virus can also be spread by pollen. Wild Prunus species growing near your planting may harbor viruses which can then be carried into your trees. Some viruses are spread from tree to tree by root grafts. There is also evidence that some viruses can be spread via pruning shears or other tools. Before virus indexing programs were started at commercial nurseries, the nurseries spread viruses through the budding and grafting processes used to produce trees. Modern sanitation programs have largely removed viruses as a problem in commercial nurseries. This is an important reason to purchase trees from a commercial nursery rather than try to propagate your own.

Prevention and control. There are no cures for viruses in plants. If you have confirmed a viral infection, the only remedy is to remove the plant. Otherwise, it can become a source of infection to nearby stone fruits.

Problem Solving

Why stone fruit trees fail to bear

Stone fruit trees can fail to bear fruit for many reasons—cold winter temperatures, spring frosts, poor pollination, age of trees, too much pruning, and too little training. This section describes the most common problems and how to avoid them.

Winter injury. Perhaps the most common problem of peaches and sweet cherries is bud injury from cold winter weather. Fruit buds are the most sensitive part of stone fruit trees. Winter temperatures below 0°F will kill fruit buds, and temperatures below about –10°F will injure or kill the trees. Planting on favorable sites is virtually the only method to help avoid winter injury

Spring frosts. Another very common problem for stone fruits is spring frosts. Temperatures at or below 30°F during or after flowering will kill the flowers and prevent fruiting. Apricots are particularly susceptible to frost damage. Stone fruits generally flower earlier than apples or pears, so they are even more prone to spring frost injury. Planting on only the best sites and planting late-flowering cultivars will reduce the problem. See the earlier section "Spring Frost Protection" for more information.

Pollination problems. Poor pollination may be due to poor weather conditions during flowering. Bees or other insects are required for pollinating stone fruit flowers. If the weather is cold, cloudy, windy, or rainy, bees do not forage well. Without insects to transfer pollen, no fruit develop. Pollen

incompatibility is another problem. Table 1 lists the pollination requirements of common stone fruits. If cross-pollination is required, a second compatible cultivar must be planted within 100 yards to be effective. Sweet cherries also can be cross-incompatible. Ask your nursery what pollinizer will be effective for the main cultivar you desire.

Tree age. Stone fruit trees must mature before they will produce fruit. The number of years required is not absolute. Some trees will bear fruit the year after planting, while others may take 5 years to begin to bear. Be patient and eliminate all other causes before implicating tree age.

Heavy pruning. Too much pruning, particularly heading cuts into 1-year-old wood, causes trees to produce strong vegetative growth. Trees that are vegetatively invigorated produce few flower buds. Heavy pruning can also remove flower buds once they have formed. Prune trees only as needed to train the tree to the desired shape and to ensure good light distribution within the canopy. Don't prune trees with hedge shears or similar tools.

Poor training. Trees that have strongly vertical limbs will produce fewer fruit than limbs with a more horizontal orientation. Training branches to grow out, rather than up, will increase their fruitfulness. See the "Training and Pruning" section for advice on correcting the problem.

Poor fruit quality

In some cases stone fruit trees will produce fruit, but the fruit is of poor quality. This section describes several problems that may lead to poor fruit quality.

Fruit from rootstock. Most stone fruit trees are "two-piece trees," composed of a rootstock and a scion. If the scion is killed but the rootstock continues to grow, the rootstock can produce fruit. Such fruit will typically be inferior in size, color, flavor, and texture if it is edible at all. Occasionally nurseries fail to remove a tree when the scion's budding or grafting was unsuccessful. If a stone fruit tree is girdled or dies back to ground level, it is better to replace the tree than to risk having the rootstock produce fruit.

Neglected plantings. Fruit quality suffers when trees are not properly trained, pruned and fertilized, or if diseases and insects are not managed. Trees may be defoliated prematurely, leading to low vigor and poor fruit quality. In other cases diseases or insects may attack the fruit itself, rendering it inedible.

Poor growing conditions. Trees planted in poor sites will likely produce poor-quality fruit. Strong shade prevents trees from manufacturing sufficient carbohydrates to produce quality fruit. Windy sites may promote the growth of wood rather than fruit. Carefully consider site selection before planting. For more information, see "Site Selection and Preparation."

Inferior cultivars. Inferior cultivars will produce inferior fruit. Also, chance seedlings will likely produce poor-quality fruit. Bush cherries, sand cherries, Nanking cherries, and cherry plums will not produce fruit of the same quality as standard tart or sweet cherries. Of course, these species will thrive and produce fruit in cold climates where conventional cherries won't thrive. For the best chance of success, plant cultivars recommended in this bulletin or Extension publications Home Fruit Cultivars for Northern Wisconsin (A2488) and Home Fruit Cultivars for Southern Wisconsin (A2582).

Why plantings fail

Plant death is usually caused by a number of factors interacting rather than by a single identifiable cause. One injury may cause enough stress to allow other problems to kill the tree. Several common reasons for tree death are described below.

Winter injury. Peach and sweet cherry trees are not reliably hardy in Wisconsin. Tart cherries, European and domestic plums, and apricots are more winter hardy, but they can still be injured by severe winter temperatures, particularly if there is no snow covering the ground.

Winter-injured trees may leaf out and flower in the spring. The leaves may be small and narrow and a lighter green color than leaves of undamaged trees. Once hot days begin, the tree will wilt and die. The layer beneath the bark (the cambium) is normally cream-colored but turns reddish brown when damaged. Other winter-injured trees don't leaf out or flower at all and appear dead from the onset of spring.

In less severe situations the trees appear healthy but weaken over time, and diseases are able to invade and ultimately kill the trees. Bacterial diseases in Wisconsin stone fruits are frequently associated with winter injury. You can minimize winter injury by selecting hardy species and cultivars, planting on only the best sites, controlling disease and insect pests, and allowing trees to "harden off" by not fertilizing after August 1 and not pruning after August 15. Branches with narrow crotches have tender wood that may never harden off fully. Spreading young limbs to create wide crotches can improve winter hardiness.

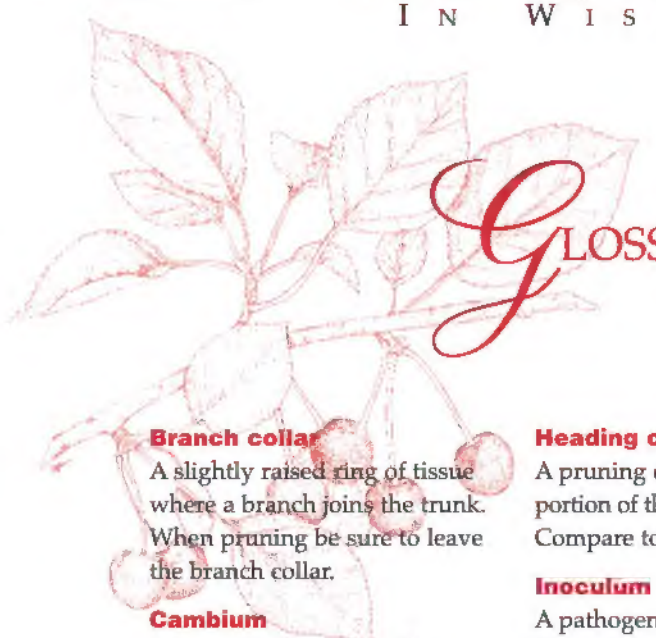
Too much water. Stone fruit trees will not tolerate "wet feet." Poor soil drainage is common in soils with a high clay content and in low areas. Standing water or soil saturation lasting more than three days during the growing season will likely damage the roots. Water fills the pores in the soil, depriving the roots of oxygen. Avoid these problems by choosing sites with good soil drainage.

Too little water. Young stone fruit trees are particularly susceptible to drought. When water is scarce, roots cannot supply enough water to replace that lost by the leaves through transpiration. Sandy soils can't hold a lot of water and are particularly drought-prone. Prevent drought stress by watering regularly. Young trees should receive 3 to 5 gallons of water per week. Irrigation also benefits older, bearing trees during dry periods.

Physical damage. Bark at the base of the trunk can be damaged by small animals feeding in the winter and by lawn mowers and string trimmers. If a complete ring of bark is removed so that the tree is girdled, death will occur shortly after growth begins in the spring. If the tree is not girdled but a large portion of the bark has been removed, the tree will weaken but may survive. To prevent physical damage, keep the area around the trunk free of grass and weeds. Don't pile mulch materials there. This will prevent rodents and rabbits from nesting and will make the trees less attractive as a food source. Keep vegetation around the planting mowed short, particularly in the fall. You can also wrap tree trunks with wire trunk-guards made from an 18-inch square of ¼- or ½-inch mesh hardware cloth. For more information about rodent control, see Extension publication Meadow Mouse Control (A2148).

Deer will also feed on fruit trees. They tend to eat the tips of shoots in late winter or early spring. When deer browse trees heavily, it is difficult to train and prune trees correctly. Deer may also rub against young trees, scraping off the bark and killing the tree. If deer pressure is heavy, only fencing will keep them away from trees. But if deer pressure is light, repellents can reduce or eliminate injury. Inexpensive repellents include human hair or slaughterhouse tankage hung in fabric net bags in each tree. Small, hotel-size bars of soap can also be effective repellents. Leave the wrapper on the bar and poke a hole through the soap, then hang it on the tree with a short piece of wire. All repellents last only a few weeks to a few months and need to be replenished often. For more information see Extension publication Controlling Deer Damage in Wisconsin (G3083).

Insect and disease pests. Severe insect or disease infestations will not only make the fruit unusable but may defoliate trees. This is particularly true late in the year. Thus, severely diseased trees go into winter under stress that may lead to winter injury. While these problems seldom kill trees outright, they often contribute to death. Manage pests using the practices described in the sections "Insect Pests" and "Diseases."



GLOSSARY

Branch collar
A slightly raised ring of tissue where a branch joins the trunk. When pruning be sure to leave the branch collar.

Cambium
A layer of quickly dividing cells, between the wood and bark in trees, where new growth appears.

Canker
A localized diseased area, frequently roundish to oblong, surrounded by healthy tissue.

Central leader
The main vertical branch of a fruit tree.

Cultivar
A contraction of "cultivated variety" used to describe different varieties within a plant species.

Extension growth
Growth at the ends of shoots resulting in length, not girth.

Girdle
To remove a complete circle of bark from a tree thus stopping the flow of nutrients from the top of the tree to the roots.

Harden off
The process of adapting from mild growing conditions to more rigorous conditions, as in the autumn.

Heading cut
A pruning cut that removes a portion of the length of a branch. Compare to thinning cut.

Inoculum
A pathogen or pathogen part that infects plants.

Mummy
Dried or shriveled fruit that may host pathogen inoculum.

Pollinator
The agent of pollen transfer, for fruit trees usually an insect.

Pollinizer
The plant that is the source of pollen transferred by the pollinator.

Rootstock
The below-ground portion of fruit trees. Rootstocks are usually genetically distinct from the scions (the aboveground portion) to which they are grafted.

Scaffold
A lateral branch arising from the main trunk or leader, forming, along with other scaffolds, the framework of the tree.

Scion
The aboveground portion of fruit trees that is grafted or budded to a rootstock.

Stomata
Small openings in leaves through which water exits (the transpiration process) and carbon dioxide enters.

Sucker
A rapidly growing shoot arising from the roots or rootstock.

Terminal growth
Growth from the end of a branch.

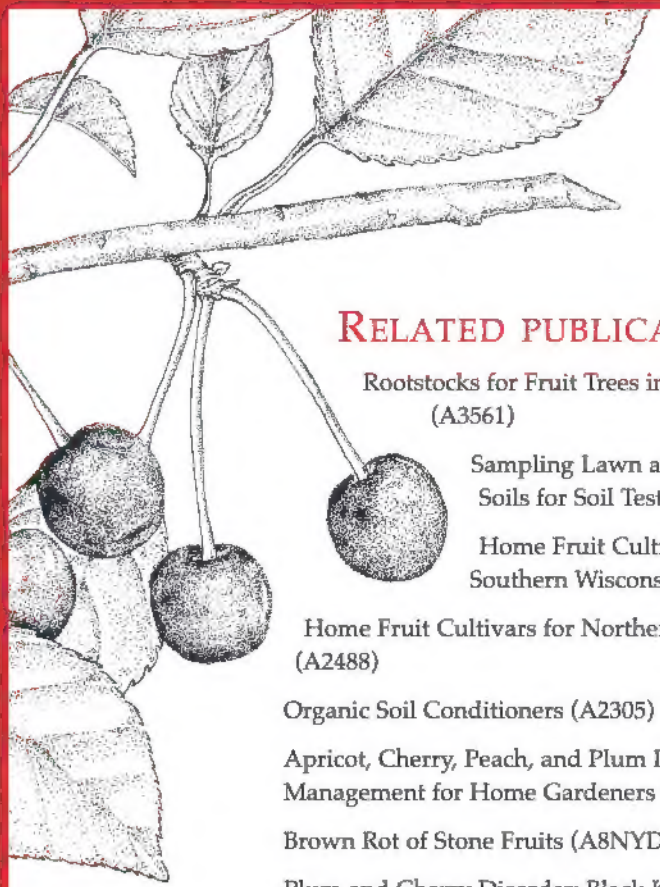
Thinning cut
Removing an entire branch at its point of origin on the trunk or a scaffold. Compare to heading cut.

Tier
One of two or more levels of branches, each level arranged one above the other.

Water sprout
A rapidly growing shoot, usually unbranched, growing on the trunk or scaffold limbs.

Whip trees
Trees from a nursery that have no branches.

Winter hardy
Capable of surviving winter temperatures encountered in the planting area.



Related publications

Rootstocks for Fruit Trees in Wisconsin (A3561)

Sampling Lawn and Garden Soils for Soil Testing (A2166)

Home Fruit Cultivars for Southern Wisconsin (A2582)

Home Fruit Cultivars for Northern Wisconsin (A2488)

Organic Soil Conditioners (A2305)

Apricot, Cherry, Peach, and Plum Pest Management for Home Gardeners (A2130)

Brown Rot of Stone Fruits (A8NYDS2)

Plum and Cherry Disorder: Black Knot (A2588)

Meadow Mouse Control (A2148)

Controlling Deer Damage in Wisconsin (G3083)

Common Tree Fruit Pests (NCR63)

Diseases of Tree Fruits in the East (NCR45)

Commercial Tree Fruit Spray Guide (A3314)

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